

# E.PROTECT+ COMPOSITE GREEN ROOF WATERPROOFING SPECIFICATION

## SECTION 07 14 16 – COLD FLUID-APPLIED WATERPROOFING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including general and supplementary conditions, and Division 1 specification section, apply to this section.

#### 1.2 SECTION INCLUDES

- A. The installation of materials designed to provide deck waterproofing protection when installed per project specification, this sections covers the composite waterproofing membrane, along with the following:
  - 1. Surface preparation and substrate treatment
  - 2. Auxiliary materials
  - 3. Prefabricated drainage mat
  - 4. Deck drain

#### 1.3 RELATED SECTIONS

- A. Section 03 15 00: Concrete Accessories
- B. Section 03 30 00: Cast-in-Place Concrete
- C. Section 03 40 00: Precast Concrete
- D. Section 07 76 16: Roof Decking Pavers
- E. Section 07 90 00: Joint Protection
- F. Section 22 14 00: Facility Storm Drainage

#### 1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide a deck waterproofing system that prevents the passage of water under hydrostatic conditions and complies with the physical requirements as demonstrated by testing performed by an independent testing agency.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of waterproofing specified submit manufacturer's printed technical data, tested physical and performance properties, instructions for evaluating, preparing, and treating substrates, and installation instructions.

- B. Shop Drawings: Project specific drawings showing locations and extent of waterproofing, details for substrate joints and cracks, sheet flashing, penetrations, transitions, and termination conditions.
- C. Samples: Submit two standard size samples of the each of the following:
  - 1. Individual components of the specified composite membrane system.
- D. Installer Certification: Submit written confirmation at the time of bid that installer is currently approved by the membrane manufacturer.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Waterproofing installer shall be an EPRO Authorized contractor who is trained and performs work that in accordance with EPRO standards and policies. For project requiring a no-dollar-limit labor and material warranty, the waterproofing installer must be E.Assurance Certified at the time of bidding and EPRO systems must be used on the below grade envelope.
- B. Certified Third Party Inspection: For projects requiring a no-dollar-limit labor and material warranty, an independent inspector must be E.Assurance Certified and comply with the documentation requirements. Inspectors must meet the requirements set forth by the manufacturer.
- C. Pre-Installation Meeting: A meeting shall be held prior to application of the waterproofing system to assure proper substrate preparation, confirm installation conditions, and any additional project specific requirements. Attendees of the meeting shall include, but are not limited to the following:
  - 1. EPRO representative
  - 2. EPRO certified installer
  - 3. Third party inspector
  - 4. General contractor
  - 5. Owners representative
  - 6. Concrete/Shotcrete contractor
  - 7. Project design team
  - 8. All appropriate related trades
- D. Field Sample: Apply waterproofing system field sample to 100 ft<sup>2</sup> (9.3 m<sup>2</sup>) of each assembly to demonstrate proper application techniques and standard of workmanship.

1. Notify composite membrane system manufacturer representative, architect, certified inspector, and other appropriate parties one week in advance of the dates and times when field sample will be prepared.
2. If architect and certified inspector determines that field sample does not meet requirements; reapply composite membrane system until field sample is approved.
3. Retain and maintain approved field sample during construction in an undisturbed condition as a standard for judging the completed composite membrane system. An undamaged field sample may become part of the completed work.

E. Materials: Waterproofing materials and system shall be single sourced.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials to site labeled with manufacturer's name, product brand name, material type, and date of manufacture. Upon the arrival of materials to the jobsite, inspect materials to confirm material has not been damaged during transit.
- B. Storage: Proper storage of onsite materials is the responsibility of the certified installer. Consult product data sheets to confirm storage requirements. Storage area shall be clean, dry, and protected from the elements. If ambient air temperatures are expected to fall below 40°F, precautions will need to be taken to protect any emulsion product from near freezing temperatures. Protect stored materials from direct sunlight.
- C. Disposal: Remove and replace any material that cannot be properly applied in accordance with local regulations and specification section 01 74 19.

#### 1.8 PROJECT CONDITIONS

- A. Slope of Substrate: The deck shall be sloped to drains at a minimum rate of ¼ inch per foot.
- B. Substrate Review: Substrates shall be reviewed by the certified installer and accepted prior to application.
- C. Penetrations: All plumbing, electrical, mechanical, and structural items to be passing through the waterproof membrane shall be positively secured in their proper positions and appropriately protected prior to membrane application.
- D. Clearance: Minimum clearance of 24 inches is required for application of spray applied polymer modified asphalt, **e.spray**. For areas with less than 24-inch clearance, the product may be applied by hand using **e.spray**.
- E. Overspray: Protect all adjacent areas not receiving waterproofing. Masking is necessary to prevent unwanted overspray from adhering to, or staining, areas not receiving the membrane. Once **e.spray** adheres to a surface it is extremely difficult to remove.
- F. Weather Limitations: Perform work only when existing and forecast weather conditions are within manufacturer's recommendations.
  1. Spray Membrane: Minimum ambient temperature be 40°F (7°C) and rising. For applications temperatures below 38 degrees, but greater than +19°F/-7°C, special equipment and material handling is needed.

## 1.9 WARRANTY

- A. General Warranty: The special warranty specified in this section shall not deprive the owner of other rights the owner may have under other provisions of the contract documents, and shall be in addition to, and run concurrent with, other warranties made by the contractor under requirements of the contract documents.
- B. Special Warranty: Submit a written warranty signed by composite membrane system manufacturer agreeing to repair or replace waterproofing that does not remain watertight within the specified warranty period. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in the specially applied concrete that exceed 1/16 inch (1.6 mm) in width.
1. Warranty Period: 10 years after the date of substantial completion.
  2. Coverage: Manufacturer will provide prorated coverage for the warranty term, agreeing to repair or replace material that does not meet requirements or remain watertight.
  3. Additional warranty options are available upon request.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: EPRO Services, Inc. (EPRO), P.O. Box 347; Derby, KS 67037; Tel: (800) 882-1896; Email: [Info@eproinc.com](mailto:Info@eproinc.com); Web: [www.euproinc.com](http://www.euproinc.com)
- B. Deck: E.Protect+ Deck – **e.spray** (60 mils), **e.poly**, **e.spray** (60 mils), **e.base 316**, **e.drain 6000**
- C. For decks requiring water retention use substituted **e.drain rs50** for **e.drain 6000**.

### 2.2 WATERPROOFING MATERIALS

- A. Polymer Modified Asphalt
1. **e.spray**: **e.spray** is a non-hazardous, low-viscosity, water-based, anionic asphalt emulsion modified with a blend of synthetic polymerized rubbers and proprietary additives. **e.spray** is highly stable during transit and proper storage, but becomes highly reactive during the spray application to form a rapidly cured membrane with exceptional bonding, elongation, and hydrophobic characteristics.

PROPERTIES	TEST METHOD	VALUE
Color		Brown to Black
Solvent Content		No Solvents
Shelf Life		6 months
Tensile Strength	ASTM 412	32 psi
Elongation	ASTM 412	4140%
Resistance to Decay	ASTM E 154 Section 13	4% Perm Los
Accelerated Aging	ASTM G 23	No Effect
Moisture Vapor Transmission	ASTM E 96	0.026 g./sq. ft./hr.
Hydrostatic Water Pressure	ASTM D 751	26 psi
Perm Rating	ASTM E 96 (US Perms)	0.21
Methane Transmission Rate	ASTM D 1434	0
Adhesion to Concrete & Masonry	ASTM C 836 & C 704	20 lbf./inch

Adhesion to HDPE	ASTM C 836	28.363 lbf./inch
Adhesion to Polypropylene Fabric	ASTM C 836	31.19 lbf./inch
Hardness	ASTM C 836	80
Crack Bridging	ASTM C 836-00	No Cracking
Low Temp. Flexibility		No Cracking at -20° C
Packaging: 55 gallon drum, 275 gallon tote, 330 gallon tote		

2. **e.spray:** *e.spray* is a medium viscosity water-based, polymer-modified anionic asphalt emulsion, which exhibits exceptional bonding, elongation and waterproofing characteristics.

PROPERTIES	TEST METHOD	VALUE
Color		Brown to Black
Solvent Content		No Solvents
Shelf Life		6 months
Tensile Strength	ASTM 412	32 psi
Elongation	ASTM 412	3860%
Resistance to Decay	ASTM E 154 SECTION 13	9% Perm Loss
Accelerated Aging	ASTM G 23	No Effect
Moisture Vapor Transmission	ASTM E 96	0.071 g/sq. ft./hr.
Hydrostatic Water Pressure	ASTM D 751	28 psi
Perm Rating	ASTM E 96 (US Perms)	0.17
Methane Transmission Rate	ASTM D 14334	0
Adhesion to Concrete & Masonry	ASTM C 836	1 lbf/inch
Hardness	ASTM C 836	85
Crack Bridging	ASTM C 836	No Cracking
Low Temp. Flexibility	ASTM C 836-00	No Cracking at -20° C
Packaging: 5 gallon bucket		

## B. Thermoplastic Membranes

1. **e.base 316:** *e.base 316* is a 16 mil geomembrane comprised of high density polyethylene (HDPE). While *e.base 316* is always installed as a component of EPRO's E.Series assemblies, it alone exceeds all Class A, B, and C vapor barrier requirements. In green roof applications, *e.base 316* also serves as a barrier to prevent overlying vegetation growth from damaging the waterproofing system.

PROPERTIES	TEST METHOD	VALUE
Material		HDPE
Color		Green
Thickness		16 mil
Classification	ATSM E 1745	Exceeds Class A, B & C
Water Vapor Permeance	ATSM E 96	.029 perms
Tensile Strength	ATSM E 154 (ATSM D 882)	63 lbf/in
Puncture Resistance	ATSM D 1709	2,750 grams Method B
Life Expectancy	ATSM E 154	Indefinite
Chemical Resistance	ATSM E 154	Unaffected
Dimensions: 12' x 150'		
Weight: 137 pounds		

C. Prefabricated Drainage

1. **e.drain rs50:** *e.drain rs50* is installed dimple side down to allow for water retention on green roof applications. The drainage core is encapsulated with a gray root barrier to prevent root systems from adversely impacting the efficiency of the drainage system, and a black geotextile on the bottom to protect the underlying waterproofing system.

PROPERTIES	TEST METHOD	VALUE
<b>DIMPLED CORE</b>		
Core Material		Polypropylene
Color		Black
Compressive Strength	ASTM D 1621	15,000 psf (719 kNm <sup>2</sup> )
Thickness	ASTM D 1777	.40 in (1.016 cm)
Flow, Hydraulic gradient = 1	ASTM D 4716	21 gal/min/ft
Water Retention		.042 gal/sq ft
<b>FILTER FABRIC</b>		
	<b>TOP FABRIC (GRAY)</b>	<b>BOTTOM FABRIC (BLACK)</b>
Basis Weight ASTM D 3776	100 gsm	120 gsm
Grab Tensile ASTM D 5034	75/70 lbf	90 lbs
Grab Elongation ASTM D 5034	40%	60%
Thickness ASTM D 1777	.49 mm	1.3 mm
Trapezoidal Tear ASTM D 1117	20 lbf	40 lbs
Water Flow Rate ASTM D 4491	250 gal/min/sq ft	140 gal/min/sq ft
Dimensions: 4' x 50'		
Weight: 88 pounds		

2. **e.drain 6000:** *e.drain 6000* features a lightweight three-dimensional, high-compressive strength polypropylene core and bonded non-woven geotextile fabric. The bonded filter fabric allows water to pass freely into the molded drain while preventing soil particles from entering and clogging the core structure.

PROPERTIES	TEST METHOD	VALUE
<b>DIMPLED CORE</b>		
Core Material		Polypropylene
Color		Black
Dimple Height	ASTM D 1777-96	0.4" (10.16mm)
Compressive Strength	ASTM D 6364-06	16,500 psf (790 kN/m <sup>2</sup> )
Flow rate	ASTM 4716	21 g/min/ft
<b>FILTER FABRIC</b>		
Grab Tensile	ASTM D 4632-91	100 lbs
CBR Puncture resis	ASTM D 6241	250 lbs
Apparent Operating Size	ASTM D 4751-99	70 sieve size (.0212mm)
Water Flow Rate	ASTM D 4491-99	140 gpm/ft <sup>2</sup> (5704 l/min/m <sup>2</sup> )
UV Resistance	ASTM D 4355-92	70% (500 hrs)
Dimensions: 6' x 50'		
Weight: 63 pounds		

## 2.3 AUXILIARY MATERIALS

- A. All accessory products shall be provided by the specified waterproofing manufacturer. Auxiliary products used in lieu of, or in addition to, the manufacturer's products must be approved in writing by EPRO.
- B. Reinforcement Fabric: Manufacturer's polyester fabric, **e.poly** is available in 6 inch, 12 inch, and 40 inch widths.
- C. Detailing Material: **e.roll**, a roller applied water based high viscosity polymer modified asphaltic material OR **e.trowel**, a trowel applied water based high viscosity polymer modified asphaltic material.
- D. Backer Rod: Closed cell polyethylene foam
- E. Termination Bar: **e.term hd**, or approved alternate

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Comply with project documents, manufacturer's product information, including product application and installation guidelines, pre-job punch list, as well as, manufacturer's shipping and storage recommendations.

### 3.2 SURFACE PREPARATION

- A. The general contractor shall engage the certified installer to ensure surfaces are prepared in accordance with manufacturer's instructions. Unless, explicitly stated in the contract documents, the certified installer is not responsible for surface preparation.
- B. Examine all substrates, areas, and conditions under which waterproofing systems will be applied, with installer and inspector present. Do not proceed with installation until unsatisfactory conditions have been corrected and a surface prep requirements have been met. If conditions exist that are not addressed in this section notify inspector and contact EPRO for additional clarification.
- C. Concrete: Application to green concrete is acceptable provided the substrate is prepared in accordance with manufacturer's written instructions
  1. Provide clean, dust-free, and dry substrate for waterproofing application.
  2. Surfaces shall be light broom finished and power washed to remove grease, oil, form release agents or any other penetrating contaminants from the concrete. No agents shall be visible prior to the application of **e.spray**.
  3. Remove all fins, ridges, and other protrusions.
  4. Fill honeycomb, aggregate pockets, tie holes, and other voids greater than 1/16 inch with hydraulic cement, or rapid-set grout.
  5. For crack treatment refer to the crack and joint repair section of this specification.

D. Plywood:

1. Provide clean, dust-free, and dry substrate for waterproofing application.
2. The plywood butt joint shall be flush with one another with less than ¼ inch gap.
3. Apply a reinforcement detail over all plywood butt joints. Apply a 30 mil coat of **e.spray** to desired area extending 3 inches beyond the joint or area of repair. Embed a **e.roll** joint reinforcing strip into the previously applied **e.spray**. Apply a second 30 mil coat of **e.spray** over reinforcement fabric ensuring full saturation.

3.3 DECK MEMBRANE INSTALLATION – E.PROTECT+ DECK

- A. General: The deck membrane shall be installed under strict accordance with the manufactures guideline and project specifications. Coordination between the installer, inspector, general contractor and concrete contractor will be necessary to ensure proper installation.

3.3.1 TREATMENT OF CRACKS, JOINTS, AND REPAIRED AREAS

- A. Treat, rout, and fill cracks larger than 1/8 inch with hydraulic cement, rapid set grout, or acrylic caulking.
- B. The following areas shall receive a reinforcement detail of **e.spray** and reinforcement fabric:
1. All cracks less than 1/8 inch.
  2. All previously repaired cracks.
  3. All cold joints.
  4. For joints larger than 1/4 inch, rout out the joint and fill with back rod and acrylic caulking. Repaired joint shall be flush with the surrounding substrate.
- C. Reinforcement Detail: Apply a 30 mil coat of **e.spray** to desired area extending 3 inches beyond the joint or area of repair. Embed a joint reinforcing strip into the **e.spray**. Apply a second 30 mil coat of **e.spray** over reinforcement fabric ensuring full saturation.



### 3.3.2 SEALING OF PENETRATIONS

- A. Standard Pipe Penetrations: Prepare membrane penetrations so they are free of any material that prohibit the material to bond directly to the penetration surface: foam, insulation, protective coatings, etc.
  1. Apply **e.spray** 3 inches horizontally and 3 inches vertically around the base of the penetration.
  2. Embed **e.roll** 3 inches horizontally and 3 inches vertically around the base of the penetration.
  3. Apply a second layer of **e.spray** to the reinforcement fabric until the reinforcement fabric is fully saturated, and then secure the reinforcement fabric to the penetration with a cable tie.
  4. Cut a target piece of reinforcement fabric to the outside diameter of the penetration.
  5. Place target piece around the penetration and embed into existing saturated reinforcement fabric, saturate fabric with **e.spray**.

### 3.3.3 SEALING OF DRAINS

1. Apply **e.spray** 3 inches around the drain and into the vertical surface of the drain.
2. Embed **e.roll** 3 inches around the drain and onto the drain housing.
3. Apply a second layer of **e.spray** to the reinforcement fabric until the reinforcement fabric is fully saturated.

### 3.3.4 POLYMER MODIFIED ASPHALT MEMBRANE

- A. Mask off adjoining surfaces where unwanted polymer modified asphalt membrane may impact other construction trades.
- B. Commence application of spray applied polymer modified asphalt when ambient air temperatures are within manufacturer recommendations.
- C. Surfaces that will receive the membrane must be clean and free from standing moisture.
- D. Start installing **e.spray** in presence of approved 3rd party inspector.
- E. Apply a 10 mil primer coat of un-catalyzed **e.spray** and allow to set. The primer coat is designed to reduce that amount of potential blistering that may occur as the concrete continues to release moisture.
- F. Moving from the low point to the high point of the deck, apply one application of un-catalyzed **e.spray** waterproofing in accordance to manufacturer's instructions in order to obtain a seamless membrane with an uncured thickness of thickness of 80 mils (2 mm).
- G. Apply waterproofing in and around penetrations and cavities to ensure the formation of monolithic seal around all penetrations.
- H. Apply waterproofing to prepared wall terminations and vertical surfaces to heights indicated according to manufacturer's recommendations and details. (if applicable)

- I. Verify film thickness of waterproofing every 1000 ft<sup>2</sup> (93 m<sup>2</sup>).

### 3.3.5 POLYMER MODIFIED ASPHALT REINFORCEMENT

- A. General: Reinforcement mesh shall be installed immediately following the first application of **e.spray**.
  1. Roll **e.roll** over the freshly applied **e.spray**.
  2. Press firmly on the **e.roll** reinforcement material so it begins to become saturated with the underling **e.spray** material.

### 3.3.6 POLYMER MODIFIED ASPHALT MEMBRANE

- A. Begin application of **e.spray** over the previously installed **e.spray** and **e.roll** reinforcement material.
- B. Moving from the low point to the high point of the deck, apply one application of **e.spray** waterproofing in accordance to manufacturer's instructions in order to obtain a seamless membrane with a minimum dry film thickness of 60 mils (1.5 mm).
- C. Apply waterproofing in and around penetrations and cavities to ensure the formation of monolithic seal around all penetrations.
- D. Apply waterproofing to prepared wall terminations and vertical surfaces to heights indicated according to manufacturer's recommendations and details. (if applicable)
- E. Verify film thickness of waterproofing every 1000 ft<sup>2</sup> (93 m<sup>2</sup>).

### 3.3.7 THERMOPLASTIC PROTECTION COURSE

- A. Whenever possible roll out **e.base 316** base layer in the same direction over the substrate. When multiple pours will occur, extend **e.base 316** a minimum of 2 feet past the pour joint. In order to ensure a proper tie-in, mask off the 2 foot section past the pour joint and protect it from damage.
- B. Overlap **e.base 316** a minimum of 6 inches.
- C. Using a hand held hot air welder similar to Leister Technologies GHIBLI-AW or an automated welder similar to Leister Technologies VARIMAT V2, calibrate equipment welder settings to create a continuous uniform weld free from fish mouths or deficiencies.
- D. Confirm seam overlaps are clean and dry prior to utilizing properly calibrated welding equipment to create a minimum 1 ½ inch welded seam.
- E. Wait for seam to cool and probe prior to smoke testing.
- F. NOTE: In windy conditions secure the **e.base 316** base course a long edges of application area using 6-inch nail with a 2 ½ inch diameter washer. If nails are used to secure the base course, a 6-inch square patch of **e.base 316** shall be centered over the nail head and then hot air welded to create watertight seal.

### 3.3.8 SEALING OF PENETRATIONS

- A. Sealing of Standard Penetrations: Prepare penetrations so they are free of any material that will inhibit a direct bond to the penetration surface.
1. Trim the **e.base 316** field base sheet to within 1/8 inch of the penetration.
  2. Cut target piece of **e.base 316** so that it extends a minimum of 6 inches from the base of the penetration.
  3. On the target piece create two offsetting “x” to the inside diameter of the pipe in order to create a total of 8 triangular flanges.
  4. Slide target piece over the penetration with the triangular flanges facing up.
  5. Heat weld the **e.base 316** target piece to the underlying **e.base 316** field base sheet.
  6. Apply **e.spray** between the triangular flanges and the penetration.
  7. Place a nylon cable tie around the penetration and firmly tighten around the penetration to reinforce the bond between the **e.spray**, the triangular tabs, and penetration.
  8. Apply **e.spray** 3 inches horizontally and 3 inches vertically around the base of the penetration.
  9. Embed reinforcement fabric 3 inches horizontally and 3 inches vertically around the base of the penetration.
  10. Apply a second layer of **e.spray** to reinforcement fabric until the reinforcement fabric is fully saturated. Secure reinforcement fabric to penetration with a nylon cable tie.
  11. Cut to a target piece of reinforcement fabric to the outside diameter of the penetration.
  12. Place target piece around the penetration and embed into existing saturated reinforcement fabric, saturate fabric with **e.spray**.

### 3.3.9 PREFABRICATED DRAINAGE MAT INSTALLATION

- A. Installation: Starting from one corner, install **e.drain 6000** over the protection course. Installation of water retaining drainage composite, use drain **e.drain rs50**
1. Secure drainage panels to the deck without penetrating the deck waterproofing system.
  2. Abut the joints of **e.drain 6000** together, so they are flush with one another.
  3. **e.drain 6000** shall be detailed around deck drains per the project drawings.
  4. Subsequent trades must contact the general contractor if damage to the deck system occurs, failure to do so may be void the warranty.

### 3.4 FIELD QUALITY CONTROL

- A. Independent inspectors and EPRO installers shall document the amount of **e.spray** used and document quantities in the inspection report.

- B. Conduct a visual inspection after the reinforced **e.spray** layer has been installed. Note any visual deficiencies and mark for repair.
- C. Decks utilizing **e.spray** must wait a minimum of 48 hours prior to conducting a flood test. For decks where **e.spray** is not utilized, **e.spray** will require a minimum of 72 hours prior to conducting a flood test.
- D. Conduct flood test for a 24 hour period by flooding deck area with a minimum of 2 inches of water. Any leaks detected should be identified, repaired, and retested. Conduct flood test PRIOR to the application of any protection course.

### 3.5 CURING PROTECTING AND CLEANING

- A. Allow for polymer modified asphaltic emulsion to fully bond with the substrate, generally this occurs 24 to 48 hours after application depending on ambient weather conditions.
- B. Take care to prevent contamination and damage during application stages and curing. All machinery, other trades, and general construction, shall NOT take place over the membrane until inspection is complete and concrete has been placed.
- C. Prevent damage during the placement of overburden.

### 3.6 REPAIRS

- A. Concrete Deck:
  - 1. Inspect damaged area to determine which system components have been damaged.
  - 2. Only patch the areas that have been damaged by re-installing the damaged materials. The patch should extend 6 inches beyond the damaged area.

End of Section